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ABSTRACT

Investigated were: (1) sex differences in the ability of 20 boys and 20 girls between 8 and 9 years of age to draw a plan of their house; and (2) variables related to such differences. Subjects were tested on four Piagetian tasks (verticality, horizontality, and two Euclidean space tasks), plan drawing, and vocabulary. After children completed the tasks, they were shown three plans that they had drawn 6 months, 3 months, and 1 week before, and were asked questions about difficulty, plan quality, satisfaction, differences between plans and pictures, and experience. Findings indicated that boys were able to draw a plan of ground floor rooms, doors, windows, and stairs earlier than girls were. A questionnaire revealed that boys and girls had differing attitudes toward the task: girls who drew plans horizontally thought it was difficult to do and were dissatisfied with the results, whereas boys thought that the task was easy and were satisfied. Girls also responded differently from boys with regard to prior experience with plans. When plan drawing was taught to 34 children matched for age and ability with 28 children in a parallel class, sex differences were not found. One-third of the girls developed dramatically from drawing vertical plans to well-structured horizontal plans, responding as though they possessed the horizontality concept, but were too unsure of themselves to use it. Four appendixes provide supplementary data as well as the study questionnaire. (RH)

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1987

SEX DIFFERENCES IN PLAN DRAWING

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SEX DIFFERENCES IN PLAN DRAWING

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SEX DIFFERENCES IN PLAN DRAWING

ABSTRACT

This paper looks at sex differences in the ability of boys and girls to draw a plan of their house and at possible mechanisms. Boys are able to draw a plan of ground floor rooms, and later doors, windows and stairs about one year earlier than girls. A questionnaire given to 8-year-old children reveals that there are different attitudes to the task, the girls who draw plans horizontally think it is difficult and are dissatisfied with their result, while boys think that it is easy and are satisfied. The girls also respond differently to experience, girls who have seen a plan at home have higher scores than those who have not, but there is no difference in the boys. Teaching enables some girls to improve their scores so much that the mean difference from the boys is eliminated.

Sex Difference Plans Social Interaction

SEX DIFFERENCES IN PLAN DRAWING

SUMMARY

(A) Sex differences in the Plan test.

This is a visuo-motor task wherein a child draws on his two-dimensional paper his conception of the ground floor plan of the three-dimensional house in which he lives.

Of the 40 items which were selected from the protocols of 1,250 children aged from 6½ to 15½ years because they showed a steady increase with age, the first six, concerned with a vertical view of the house, showed no difference in their occurrence between boys and girls (Appendix A). However, from eight years, when the children started to represent rooms, doors, windows and stairs horizontally in that order, the boys' sample achieved each item at a younger age than the girls' sample (Table 1 and Appendix B).

When the test was standardised on another sample of 890 boys and 1,004 girls, the same difference was found with the boys scoring significantly higher than the girls from 8 years to 13 years 11 months (Table 2). This meant that the test had to be scaled separately for boys and girls for the mean scores of the girls were about one year behind those of the boys (Appendix C).

The greatest increases in the scores were in the primary school children. Eight of the items, concerning horizontality of doors, windows and stairs, and proportions were never completely achieved by more than 80 per cent of the sample even at 15 years.

The same mean scores and sex differences were found in a school in Italy, suggesting that these findings may be representative of other European children.

(B) Piagetian study.

Since the major conceptual change from viewing the house vertically to viewing it horizontally took place during Piaget's concrete operational

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stage, it was decided to look at the relationship between children's ability to draw at least 50 per cent of each room horizontally with their ability to understand:

a) Verticality, as measured by drawing a plumb line in a tilted jar (Piaget, 1956)

b) Horizontality, as measured by drawing in the surface of the water in a tilted jar (Piaget, 1956)

c) Euclidean space, as measured by drawing a line parallel to another one (Thorstad, 1974)

d) Euclidean space, as measured by copying a point drawn in the corner of a right angle (Piaget, et al. 1960)

Twenty boys and twenty girls aged between 8 and 9 years were tested on the above tasks, as well as on plan drawing and vocabulary (The Crichton Vocabulary Scale, 1950). There was no significant difference in their mean ages, or in their mean vocabulary scores.

Scoring the four Piaget tasks as right or wrong, and the Plan as vertical or horizontal, a greater percentage of boys than girls was found to pass each task, although the order of difficulty was the same for both sexes. The easiest was the plumb line, the Plan and the water level tied for the second place, the drawing of a parallel line fourth and the drawing of a point fifth (Table 3). However, although the sex differences approached significance in the verticality and horizontality tasks at $P < 0.10$, none of the others were significantly different (Table 4).

Nevertheless, there was a relationship between horizontal plan drawing and the number of Piaget type tests correct which was greater in the girls than the boys (Tables 5.1 and 5.2).

(C) Questionnaire.

After the children had completed the Piaget tests, they were shown three plans that they had drawn six months, three months and one week previously, and asked (Appendix D):

1) If they had found the task easy or difficult?

2) Which was the best plan?

3) If they were satisfied with it?

4) What was the difference between a plan and a picture?

5) Had they seen a plan before?

6) Had they drawn a plan before?

The responses to questions (1) and (3) revealed personality differences in the boys' and the girls' attitudes to the task (Table 6.1 and 6.3). The girls, who had not solved the problem of a plan's horizontality thought plan drawing easy and those that had, thought it was difficult. Some of the boys reacted in this way too, but some, who had solved the problem, thought plan drawing was easy. The same differences occurred in the question on satisfaction, the girls were satisfied when they were drawing vertical plans and dissatisfied when they saw the nature of the problem and began to draw horizontal plans. Some boys also reacted similarly, but others said they were satisfied when they began to draw horizontal plans.

In response to questions (2) and (4), children who could give relevant reasons (Tables 6.2 and 6.4) scored higher on the Plan test than those who could not (Table 6.5). Ability to verbalise was associated with ability on the vocabulary test in the boys, but with success on the Piaget tasks in the girls (Table 6.6).

In response to questions (5) and (6), none of the children mentioned the plan which they had seen and drawn two weeks earlier in school. Instead they spoke about home and neighbourhood experiences, the boys reporting seeing plans in and outside their homes, the girls only inside their homes. When the children were divided into those who had seen plans and those who had not, the children who had seen plans scored higher, but only the difference in the girls' score was significant. There was no difference in age, vocabulary or Piaget scores in either groups (Table 6.7).

(D) Teaching.

Plan drawing was taught to 34 children matched for age and ability with 28 children in a parallel class, mean ages about 7 years 10 months. Both classes were tested, then the experimental class was given a lesson and tested again. Both classes were then retested a month later. The lesson was intended to give insight into the task by the teacher drawing a plan of a model house, and the children drawing plans of models they had made out of shoe boxes. The means of the boys and girls in the experimental class were not significantly different from their controls, but the boys' score was slightly lower and the girls' score higher (Table 7.1 and 7.2). The latter was because one third of the girls had made large increases, going from drawing vertical, to well structured, horizontal plans, as though they already had the concept before, but were too unsure of themselves to use it. There was a high correlation in the boys' test and retest scores, but not in the girls' scores (Table 7.3).

TABLE 1

TABLE 1. AGES AT WHICH 50% OF CHILDREN PASS EACH ITEM

Item definitions as for Fourth and Final Scoring System	ITEM	AGES IN YEARS Boys	Girls	Both
1	Roof absent	6.9	6.9	6.9
2	Chimney "	6.9	6.9	6.9
3	Upstairs "	7.0	7.0	7.0
4	Plan of outside wall absent	6.9	6.9	6.9
5	Floor indicated	7.7	7.6	7.7
6	Depth "	7.8	7.5	7.7
7	Rooms horizontal	8.0	8.1	8.1
8	All rooms connected	8.3	8.7	8.6
9	All walls common	8.6	9.2	8.7
10	Outer Wall I	8.5	9.2	8.7
11	Outer Wall II	9.0	11.0	9.9
12	Rooms : Proportion	11.0	11.0	11.0
13	Hall I	8.8	10.2	9.2
14	Hall II	9.1	12.0	10.8
15	Hall : Proportions	12.0	13.2	12.9
16	Horizontal stairs	8.8	9.2	9.1
17	Staircase I	9.2	13.6	11.0
18	" II	10.8	13.8	13.4
19	Staircase Proportion	12.5	13.8	13.2
20	Treads I	9.2	12.4	11.2
21	" II	14.5	-	14.8
22	Doors : Number I	8.3	9.0	8.7
23	" " II	9.2	10.8	10.7
24	" : Type I	9.0	10.6	9.5
25	" " II	9.2	13.0	10.9
26	" " III	13.1	15.0	13.2
27	Doors : Proportion	13.6	-	-
28	Windows : Number I	8.8	9.4	8.9
29	" " II	9.3	10.3	10.2
30	" Type I	9.2	11.6	9.8
31	" " II	10.9	13.0	11.1
32	" " III	13.1	15.2	13.1
33	No unaccounted for space	10.8	12.9	11.0
34	No vertical walls	8.8	8.8	8.8
35	Proportion : Number correct I	10.8	10.8	10.8
36	" " " II	12.0	13.0	12.7
37	" " " III	13.8	-	-
38	" " " IV	13.8	-	-
39	Quality of drawing I	9.4	10.8	10.5
40	" " II	13.4	13.8	12.5

TABLE 2. DIFFERENCES BETWEEN THE MEAN PLAN SCORES OF BOYS AND GIRLS AGED FROM 7 YEARS to 13 YEARS 11 MONTHS.

	BOYS			GIRLS				
	N	M	SD	N	M	SD	t	P
7	86	5.22	6.64	114	4.79	4.24	0.53	.60
8	110	13.35	8.59	116	10.85	7.37	2.34	.02
9	87	21.48	8.46	101	15.10	8.50	5.14	.001
10	92	22.95	8.37	96	18.19	8.15	3.95	.001
11	130	29.63	7.59	90	22.46	7.73	6.81	.001
12	113	29.68	5.11	173	25.33	7.69	5.72	.001
13	140	31.13	8.01	152	29.18	8.50	2.02	.05

TABLE 3

NUMBER OF CHILDREN SUCCEEDING ON ITEM 7 OF THE PLAN TEST AND THE PIAGET TASKS, EXPRESSED AS PERCENTAGES.

	PLAN ITEM 7		PIAGET TASKS							
			a		b		c		d	
	N	%	N	%	N	%	N	%	N	%
BOYS	23	58	22	55	30	75	23	58	2	5
GIRLS	20	50	13	33	21	53	20	50	0	0
Order of Difficulty	3.5		2		5		3.5		1	

TABLE 4. DIFFERENCES BETWEEN THE NUMBER OF BOYS AND GIRLS SUCCEEDING ON PIAGET ITEMS AND IN DRAWING A PLAN HORIZONTALLY.

	BOYS N=40	GIRLS N=40	CHI SQUARE	P
Verticality	30	21	3.46	.10
Horizontality	22	13	3.25	.10
Parallel lines	23	20	0.20	NS
Point in angle	2	0	0.51	NS
Plan	23	20	0.20	NS

TABLE 5.1

ASSOCIATION BETWEEN HORIZONTALITY IN THE PLAN AND ITEMS ON THE PIAGET TESTS.

a. Horizontality of water level and Plan.

BOYS

	PLAN: Horizontal	PLAN: Vertical
Hor. Water	17	5
Not Hor.	6	12

Chi-square 6.126 P.05

GIRLS

	PLAN: Horizontal	PLAN: Vertical
Hor. Water	11	2
Not Hor.	9	18

Chi-square 7.293 P.01

b. Verticality of plumb line and horizontality of plan.

BOYS

	PLAN: Horizontal	PLAN: Vertical
Vertical PLUMB LINE	20	10
Not Vertical	3	7

Chi-square 2.762 P.1

GIRLS

	PLAN: Horizontal	PLAN: Vertical
Vertical	14	7
Not Vertical	6	13

Chi-square 3.609 P.05

c. Parallel lines and horizontal plan

BOYS

	PLAN: Horizontal	PLAN: Vertical
Correct Parallel Lines	16	7
Incorrect	7	10

Chi-square 2.166 NS

GIRLS

	PLAN: Horizontal	PLAN: Vertical
Correct	15	5
Incorrect	5	15

Chi-square 8.100 P.01

TABLE 5.2

ASSOCIATION BETWEEN HORIZONTALITY IN THE PLAN AND ITEMS ON THE PIAGET TESTS.

a. Horizontality of water level and Plan.

	BOYS PLAN		GIRLS PLAN	
	Horizontal	Vertical	Horizontal	Vertical
Hor. Water	17	5	11	2
Not Hor.	6	12	9	18
	Chi-square 6.126 P.05		Chi-square 7.293 P.01	

b. Verticality of plumb line and horizontality of plan.

	BOYS PLAN		GIRLS PLAN	
	Horizontal	Vertical	Horizontal	Vertical
Vertical PLUMB LINE	20	10	14	7
Not Vertical	3	7	6	13
	Chi-square 2.762 P.1		Chi-square 3.609 P.05	

c. Parallel lines and horizontal plan

	BOYS PLAN		GIRLS PLAN	
	Horizontal	Vertical	Horizontal	Vertical
Correct Parallel Lines	16	7	15	5
Incorrect	7	10	5	15
	Chi-square 2.166 NS		Chi-square 8.100 P.01	

TABLE 6.1

COMPARISON OF TEST SCORES BETWEEN CHILDREN WHO THOUGHT PLAN DRAWING A EASY; B DIFFICULT, BUT WITH IRRELEVANT REASONS; C DIFFICULT WITH RELEVANT REASONS.

	A		B		C	
BOYS	(N = 16)		(N = 7)		(N = 17)	
	M	SD	M	SD	M	SD
Plan	11.06	7.34	7.57	4.23	16.06	9.59
Piaget	7.87	2.89	6.71	1.48	8.11	1.78
Vocabulary	37.75	0.44	30.05	7.79	40.23	8.16
Age	8y 8.50m	2.60	8y 6.28m	3.25	8y 6.00m	3.06
GIRLS	(N = 13)		(N = 8)		(N = 19)	
Plan	5.38	4.41	8.87	6.45	14.10	7.38
Piaget	5.92	1.66	7.25	2.12	7.42	1.77
Vocabulary	33.77	9.76	42.25	8.96	41.53	7.21
Age	8y 6.46	3.78	8y 7.12m	3.04	8y 7.68	3.48

TABLE 6.2

COMPARISON OF TEST SCORES BETWEEN CHILDREN WHO A CHOSE INCORRECTLY, B CHOSE CORRECTLY GIVING IRRELEVANT REASONS, C CHOSE CORRECTLY GIVING RELEVANT REASONS

	A		B		C	
BOYS	N = 17		N = 14		N = 9	
	M	SD	M	SD	M	SD
Plan	10.17	9.19.	12.35	8.34	17.44	5.46
Piaget	6.88	1.91	8.36	2.58	8.44	1.97
Vocabulary	34.41	9.03	40.42	5.67	39.22	10.63
Age	8y 6.11m	3.08	8y 7.57m	2.73	8y 8.00m	3.46
GIRLS	N = 12		N = 13		N = 15	
	M	SD	M	SD	M	SD
Plan	5.00	1.81	11.23	7.95	13.53	3.61
Piaget	5.67	1.67	7.08	1.71	7.73	1.79
Vocabulary	36.33	7.08	38.77	11.09	41.73	8.36
Age	8y 6.75m	3.14	8y 7.61m	4.75	8y 7.94m	3.49

TABLE 6.3

COMPARISON OF TEST SCORES BETWEEN CHILDREN WHO WERE A SATISFIED WITH THEIR PLANS, B NOT SATISFIED BUT GIVING IRRELEVANT REASONS, C NOT SATISFIED AND GIVING RELEVANT REASONS.

	A		B		C	
BOYS	N = 16		N = 19		N = 5	
	M	SD	M	SD	M	SD
Plan	10.86	9.15	13.26	8.89	15.40	2.70
Piaget	6.56	2.07	8.63	2.30	8.40	1.02
Vocabulary	35.50	9.64	39.05	8.50	38.60	5.31
Age	6.62	3.03	7.94	3.00	5.00	2.91
GIRLS	N = 16		N = 16		N = 8	
	M	SD	M	SD	M	SD
Plan	8.25	6.44	10.62	6.84	15.00	8.48
Piaget	7.00	2.10	6.56	1.75	7.37	1.85
Vocabulary	37.62	8.50	38.06	10.63	44.87	7.59
Age	8y 6.35m	3.03	6.62	3.46	9.87	3.27

TABLE 6.4

COMPARISON OF TEST SCORED BETWEEN CHILDREN WHO THOUGHT THERE WAS A NO DIFFERENCE BETWEEN A PICTURE AND A PLAN, B A DIFFERENCE BUT GAVE AN IRRELEVANT REASON, C A DIFFERENCE AND GAVE RELEVANT REASON.

	A		B		C	
BOYS	N = 9		N = 25		N = 6	
	M	SD	M	SD	M	SD
Plan	8.77	7.40	12.36	8.00	19.16	9.37
Piaget	7.44	2.33	7.64	2.48	7.82	3.23
Vocabulary	33.55	5.85	38.24	8.71	41.00	10.37
Age	8y 8. 2m	2.17	8y 6.76m	2.90	8y 8.16m	4.54
GIRLS	N = 23		N = 12		N = 5	
	M	SD	M	SD	M	SD
Plan	7.87	6.85	11.67	6.89	17.60	5.68
Piaget	6.13	1.60	7.17	1.95	9.20	0.84
Vocabulary	38.22	7.80	41.58	1.87	37.60	7.23
Age	8y 6.18m	3.71	8y 8.50m	2.78	8y 8.60	2.41

TABLE 6.5

SIGNIFICANCE OF DIFFERENCE BETWEEN PLAN MEAN SCORED OF GROUPS AB, AC and BC

	BOYS						GIRLS					
	AB		AC		BC		AB		AC		BC	
QUESTION	t	P	t	p	t	p	t	P	t	P	t	P
1. Difficulty	1.15	NS	1.67	NS	1.67	NS	1.48	NS	3.84	.001	1.74	NS
2. Choice	0.50	NS	2.17	.05	1.61	NS	2.67	.02	3.80	.001	0.54	NS
3. Satisfaction	0.78	NS	1.07	NS	0.52	NS	0.66	NS	2.19	.05	1.60	NS
4. Difference	0.49	NS	2.40	.05	2.40	.05	1.55	NS	2.96	.01	1.69	NS

TABLE 6.6

SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF PIAGET AND VOCABULARY TESTS IN GROUPS A AND C IN BOYS AND GIRLS

BOYS	PIAGET A/C		VOCABULARY A/C	
QUESTIONS	t	P	t	P
1. Difficulty	0.23	NS	0.86	NS
2. Choice	1.95	.1	1.34	NS
3. Satisfaction	1.87	.1	0.70	NS
4. Difference Plan/Picture	0.25	NS	1.79	NS

GIRLS	PIAGET A/C		VOCABULARY A/C	
QUESTIONS	t	P	t	P
1. Difficulty	2.50	.02	2.89	.01
2. Choice	3.13	.01	1.78	NS
3. Satisfaction	0.43	NS	1.02	NS
4. Difference Plan/Picture	3.97	.001	0.16	NS

TABLE 6.7

COMPARISON OF TEST SCORES BETWEEN CHILDREN WHO HAVE NOT SEEN AND SEEN A PLAN

	Not seen		Seen			
	N = 18		N = 22			
BOYS	M	SD	M	SD	t	P
Plan	11.11	8.13	18.77	8.39	0.98	NS
Piaget	7.5	1.86	8.09	2.83	0.78	NS
Vocabulary	34.61	8.78	39.82	8.66	1.85	NS
Age	8y 6.83m	2.54	8y 7.23m	3.75	-	NS
	N = 20		N = 20			
GIRLS	M	SD	M	SD	t	P
Plan	7.55	5.73	12.90	7.63	2.46	.05
Piaget	6.25	1.76	7.55	1.74	1.32	NS
Vocabulary	39.15	7.48	40.25	10.43	0.40	NS
Age	8y 7.60m	3.19	8y 6.80m	3.60	-	NS

TABLE 7.1

DIFFERENCES BETWEEN MEANS OF BOYS AND GIRLS SEPARATELY

	CONTROL		EXPERIMENTAL			
BOYS	N = 10			N = 13		
TEST	MEAN	S.D	MEAN	S.D	't'	P
1	9.60	6.44	9.69	8.36	.09	NS
2	-	-	12.30	10.18	-	-
3	12.50	7.95	11.15	9.32	1.35	NS
GIRLS	N = 18			N = 21		
1	6.28	6.98	5.67	2.40	0.61	NS
2	-	-	9.09	6.79	-	-
3	10.00	7.92	11.48	8.13	1.48	NS

TABLE 7.2

MEAN DIFFERENCE BETWEEN TEST 1 and 3

	CONTROL		EXPERIMENTAL			
	N	M	N	M	t	P
BOYS	10	2.90	13	1.46	1.01	NS
GIRLS	18	3.72	21	5.72	0.88	NS

TABLE 7.3

CORRELATIONS BETWEEN TEST AND RETEST SCORES

CONTROL GROUP

BOYS

TESTS	1	2	3
1		-	.851
2	-		-
3	.75	-	

GIRLS

EXPERIMENTAL GROUP

BOYS

TESTS	1	2	3
1		.972	.974
2	.271		.979
3	.140	.771	

GIRLS

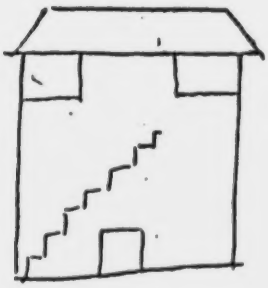
APPENDIX A

FOURTH AND FINAL SCORING SYSTEM

Items 1-7 apply to all plans. Items 8-40 apply only to horizontal plans.

1. ROOF ABSENT

No Credit



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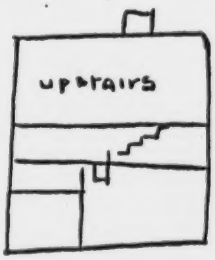
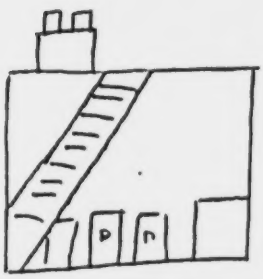


2. CHIMNEY ABSENT

No Credit



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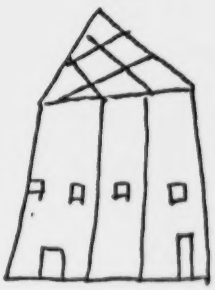

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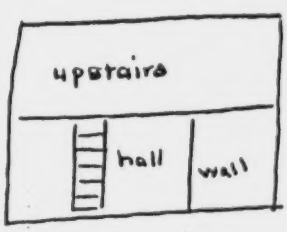
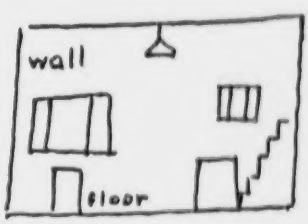
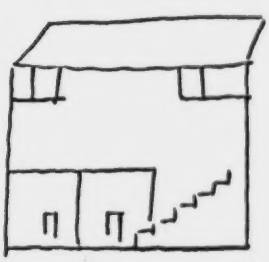


Credit



4. PLANE OF OUTSIDE WALL ABSENT

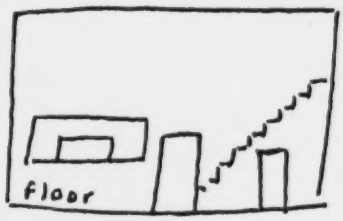
No Credit



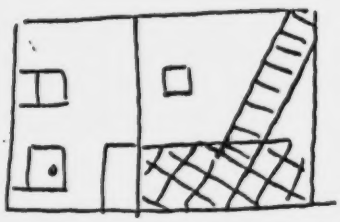
Credit

5. FLOOR — Floor marked by word or self evident

Credit

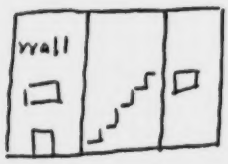


Credit

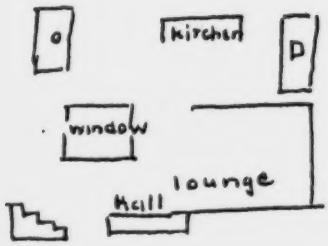


6. DEPTH — Depth indicated. May or may not have outer wall.

No credit



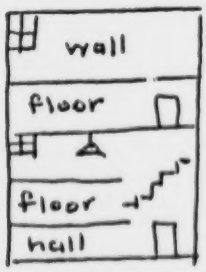
Credit



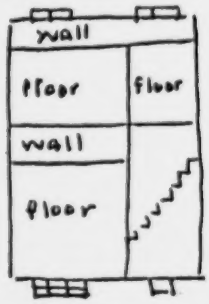
Credit

7. HORIZONTAL STRUCTURE More than 50% of each room horizontal

Vertical



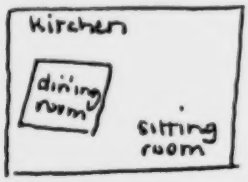
Horizontal



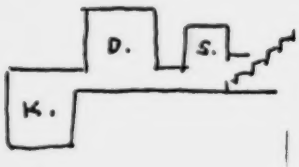
NOTE: Only proceed if this item is correct.

8. CONNECTEDNESS — All rooms connected in some way, even if by vertical walls and doors.

No Credit



Credit

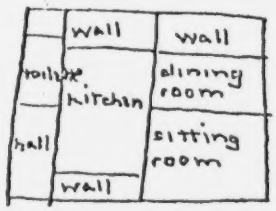


NOTE: If Item 8 is incorrect do not consider any other items except 16, 20, 22, 24, 25, 26, 27, 28, 30, 31, 32 and 34.

9. COMMONALITY — All walls of rooms and hall common.

No Credit

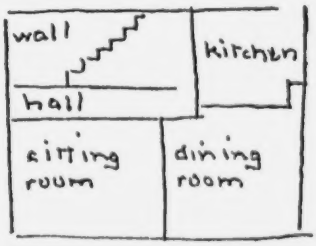
Credit



10. OUTER WALL I — At least three quarters of outer wall common with internal rooms. Only walls drawn as cross-sections included.

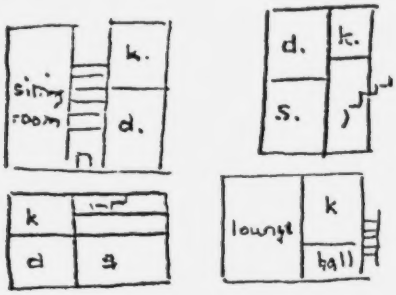
No Credit

Credit



11. OUTER WALL II — Completely correct. Do not credit if there is a break in the wall by the stairs, or if stairs are drawn outside wall.

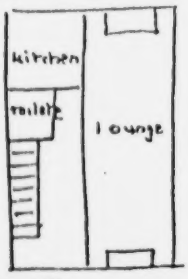
No Credit



Credit

12. ROOMS: PROPORTIONS — No room should have the length greater than twice the width, except a through room where length may be two and a half times width. The area of the kitchen should be less than the largest living room and greater than one sixth. The toilet, cloakroom or cupboard should not be greater than the area of half the kitchen. Only consider this item if the rooms are rectangular.

No Credit

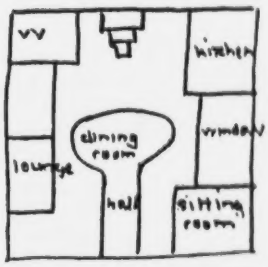


Credit

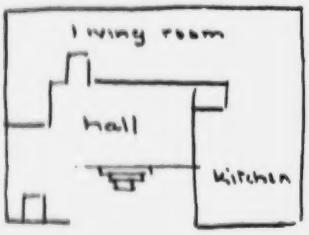
13. HALL I

At least three walls correct. The fourth may be incorrect owing to the stairs being vertical.

No Credit



Credit

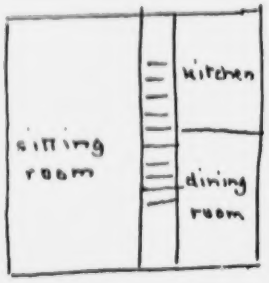


14. HALL II

Three walls correct and limits adjoining staircase correctly indicated.

No Credit

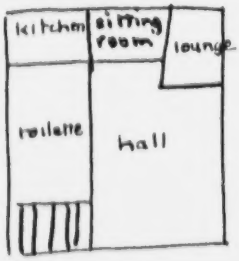
Credit



15. HALL : PROPORTIONS

The width should be less than half-width of largest room but greater than one sixth. Only consider if Item 14 is correct.

No Credit



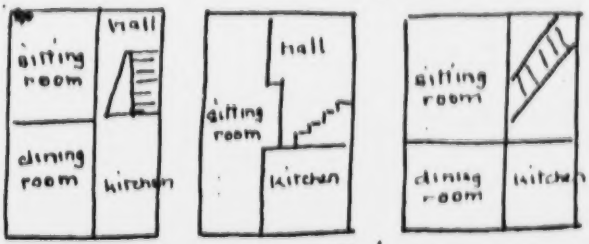
Credit

NOTE: If stairs are drawn vertically continue with Item 22.

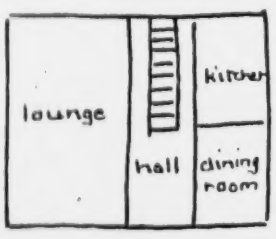
16. HORIZONTAL STAIRS

The staircase is usually rectangular and always parallel or at right angles to a wall.

No Credit



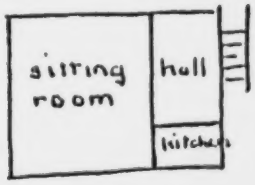
Credit



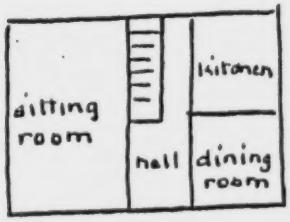
17. STAIRCASE I

The staircase is correctly integrated with the plan, with no vertical walls or unaccounted for spaces, but upper or lower limits may be incorrect.

No Credit



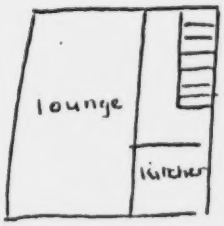
Credit



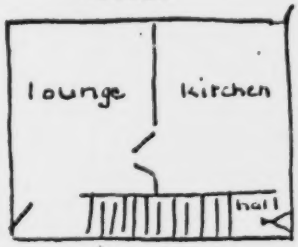
18. STAIRCASE II

Staircase completely correct, rectangular, integrated with plan and upper and lower limits correct.

No Credit



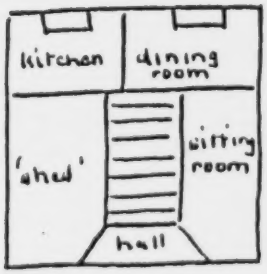
Credit



19. STAIRCASE : PROPORTION

Width of staircase should not be less than one sixth or greater than one third of width of largest room. Item 17 must be correct.

No Credit

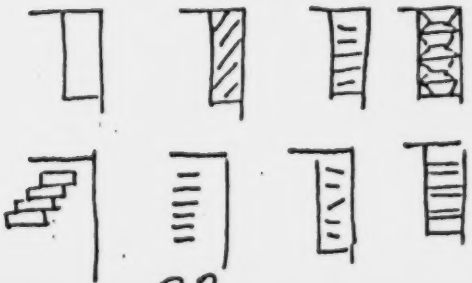


Credit

20. TREADS I

Treads drawn carefully with parallel lines. Only consider if Item 16 is correct.

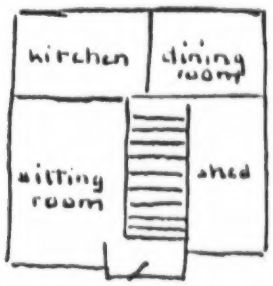
No Credit



Credit

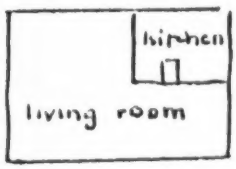
21. TREADS II — Treads almost or wholly correct; equal spacing, appropriate depth and less than 20.

Credit

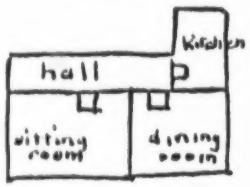


22. DOORS: NUMBER I — At least two or more doors, but incomplete because some rooms are without necessary access. Any representation acceptable.

No Credit



Credit

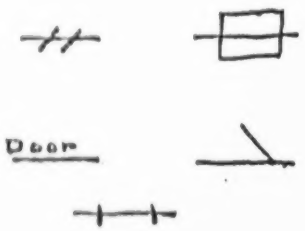


23. DOORS: NUMBER II — All doors present. No room without access together with a front and back door.

24. DOORS: TYPE I — Type of door is judged independently of the number of doors. A vertical picture is not acceptable.

No Credit

Credit



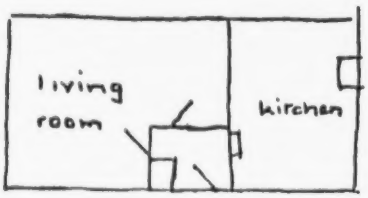
25. DOORS: TYPE II — Position and width of door or its frame indicated.

Credit

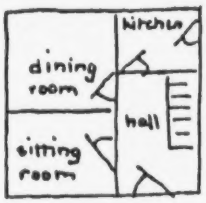
26. DOORS : TYPE III

All doors indicated as in architects' plans.

No credit



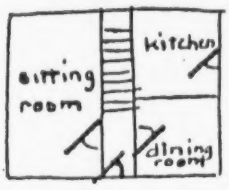
Credit



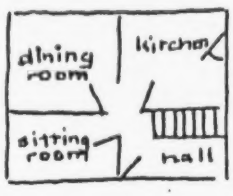
27. DOORS : PROPORTION

Width should not be more than one quarter of largest room, or less than one sixth of the width of the kitchen. Only consider if item 25 is correct and all doors are the same size.

No credit



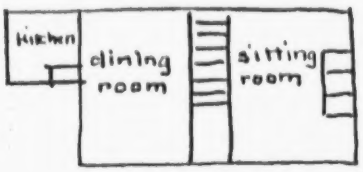
Credit



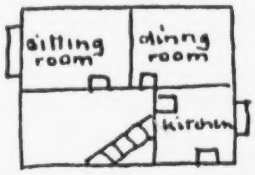
28. WINDOWS : NUMBER I

At least two or more windows present, but one or more rooms without windows. Any type of window acceptable. Window must be attached to outside wall.

No credit



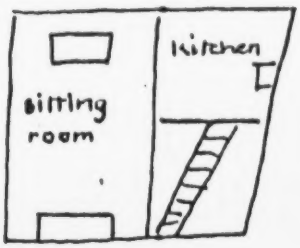
Credit



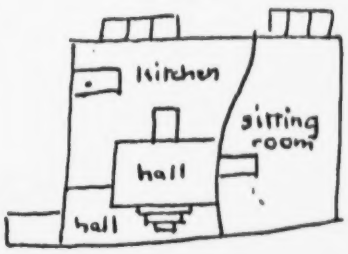
29. WINDOWS : NUMBER II

All windows present, any type accepted if attached to outside wall

No credit



Credit

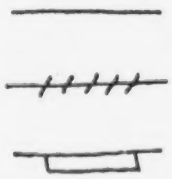


30. WINDOW : TYPE I

Type of window, judged independently of number of windows. Vertical picture not accepted.

No Credit

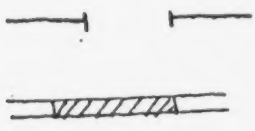
Credit

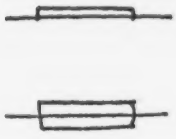


31. WINDOW : TYPE II

Width of window indicated

Credit

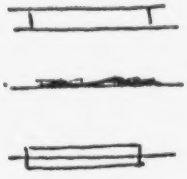




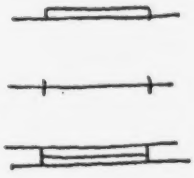
32. WINDOW : TYPE III

All windows indicated as in architects' plans and carefully drawn.

No Credit



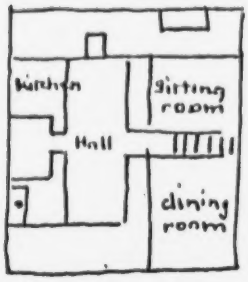
Credit



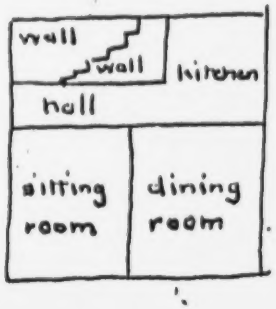
33. NO UNACCOUNTED FOR SPACE

Usually unaccounted for spaces occur where the walls are not common or when the staircase is incorrect.

No Credit

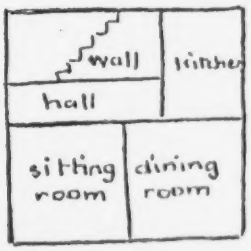


Credit



34. NO VERTICAL WALLS — Vertical walls of rooms are sometimes seen and often associated with the stairs.

No Credit



Credit

NOTE: Look at Numbers 12, 15, 19 and 27 and score 35 to 38.

35. PROPORTIONS I — At least one correct proportion

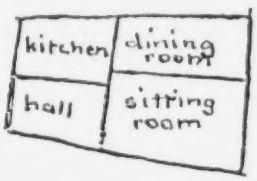
36. PROPORTIONS II — " " two " proportions

37. PROPORTIONS III — " " three " "

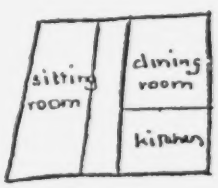
38. PROPORTIONS IV — " " four " "

39. QUALITY OF DRAWING I — At least half the lines are straight and two of the corners of the outer wall right angles.

No Credit

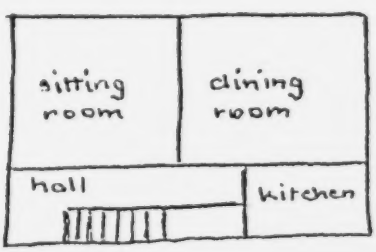


Credit



40. QUALITY OF DRAWING II — All lines straight and parallel.

Credit



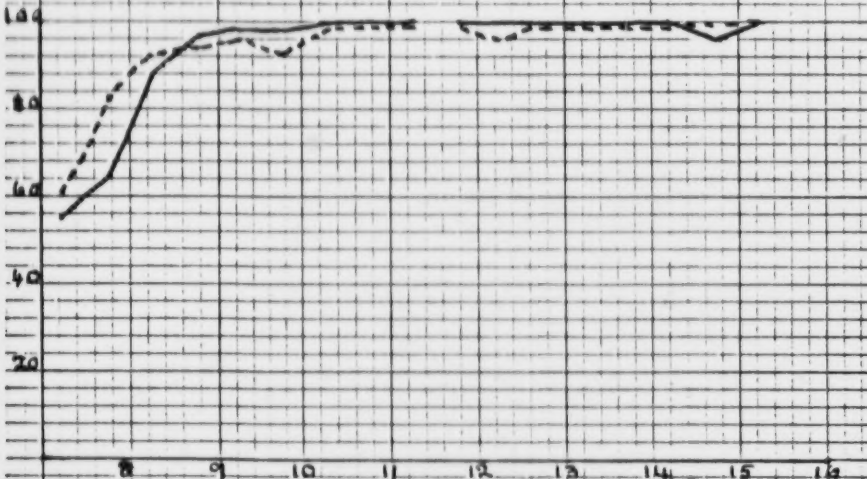
APPENDIX B

Percentages of children passing each item from 7 to 16 years.

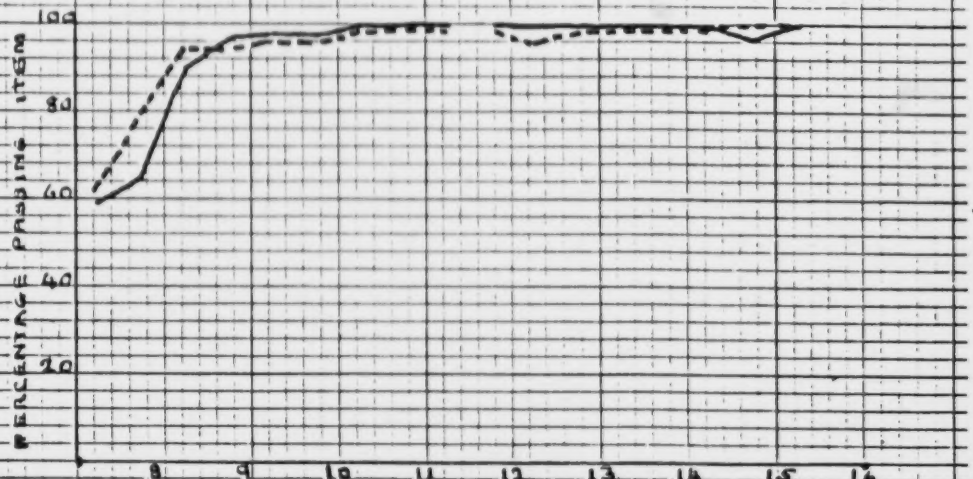
GRAPHS 1·1 to 1·40 FOURTH AND FINAL SCORING SYSTEM

BOYS ——
GIRLS - - -

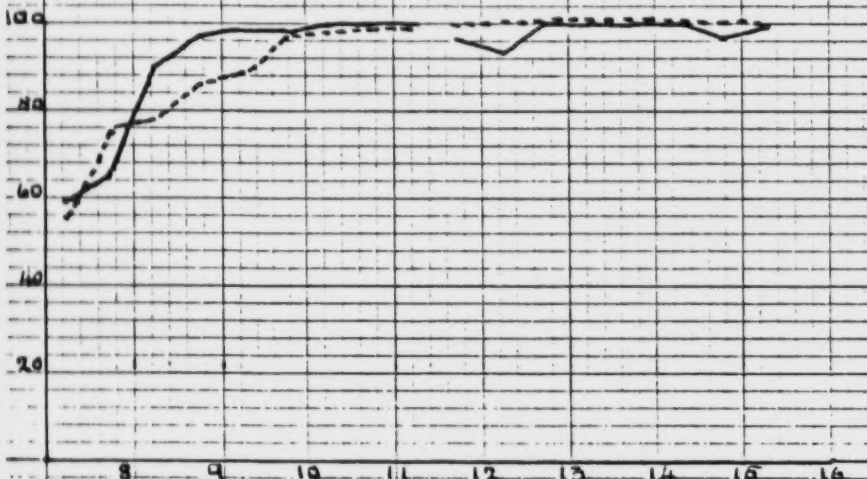
1 ROOF ABSENT



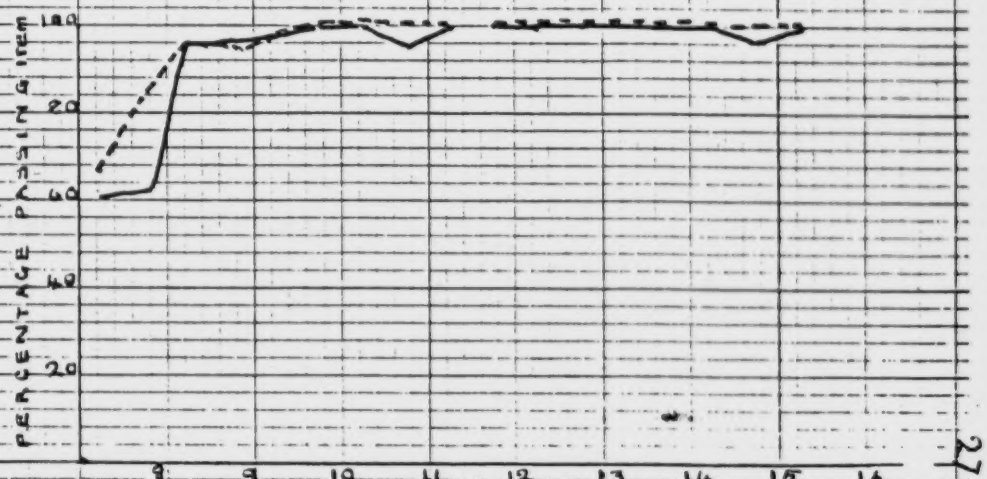
2 CHIMNEY ABSENT



3 UPSTAIRS ABSENT

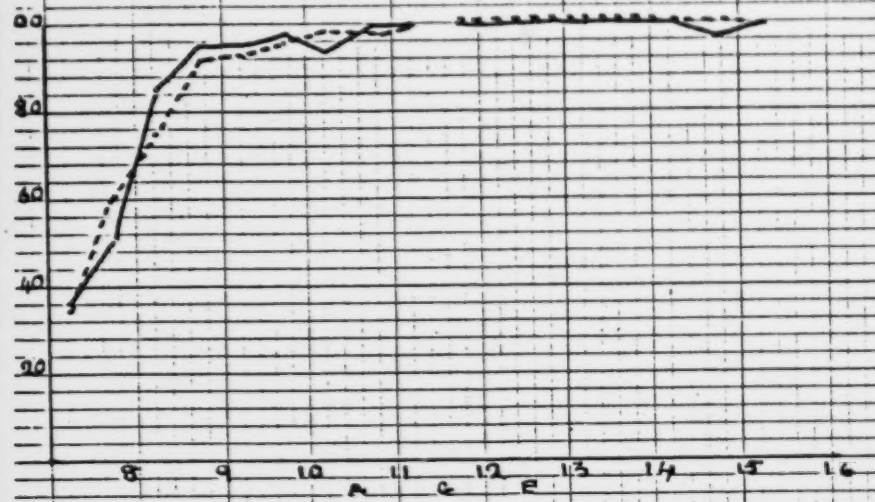


4 PLANE OF OUTSIDE WALL ABSENT



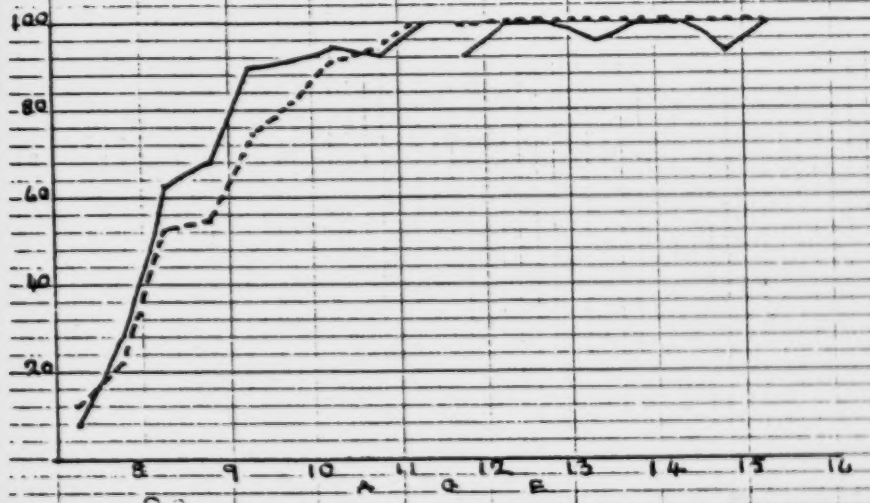
BOYS ——
GIRLS - - -

5 FLOOR

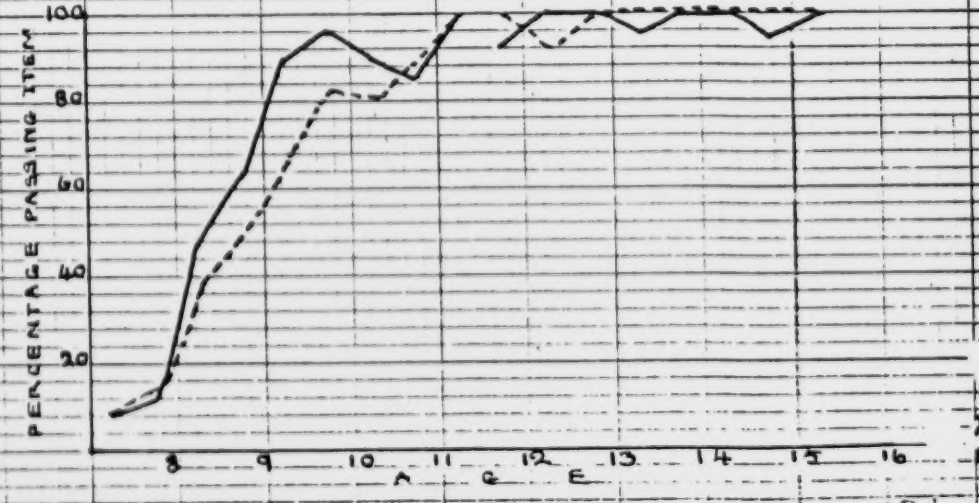


6 DEPTH

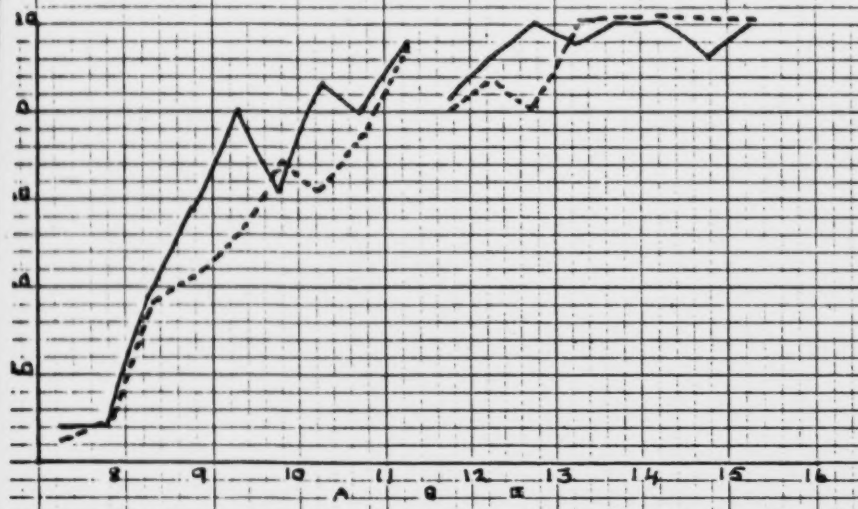
7 HORIZONTAL STRUCTURE



8 CONNECTEDNESS

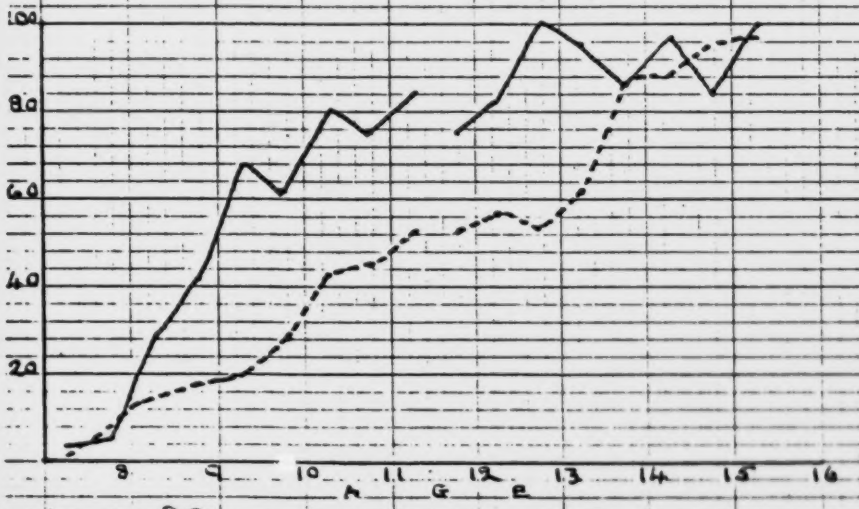


9 COMMONALITY

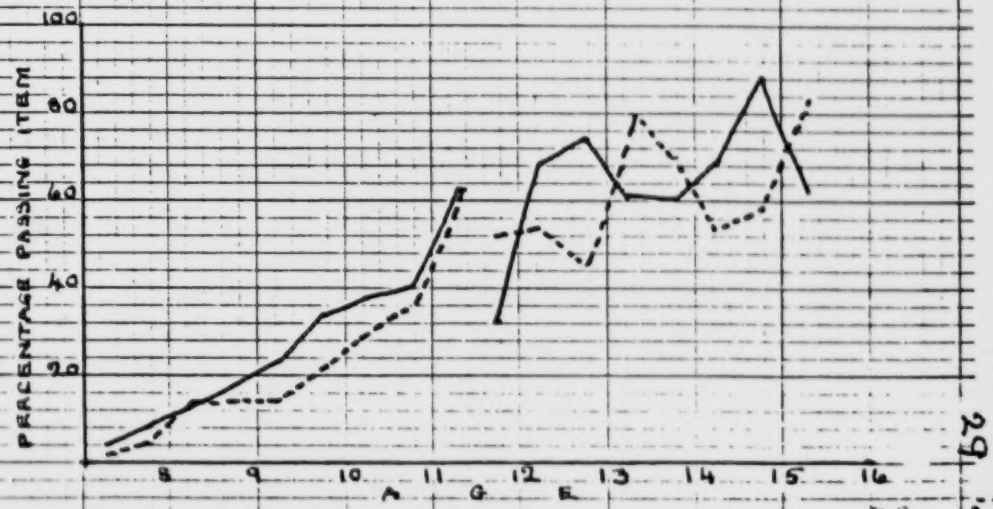


10 OUTER WALL I

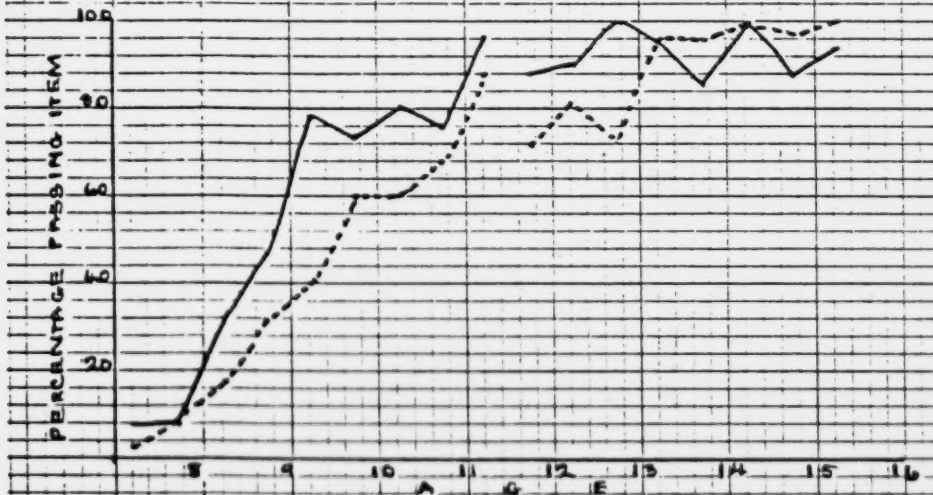
11 OUTER WALL II



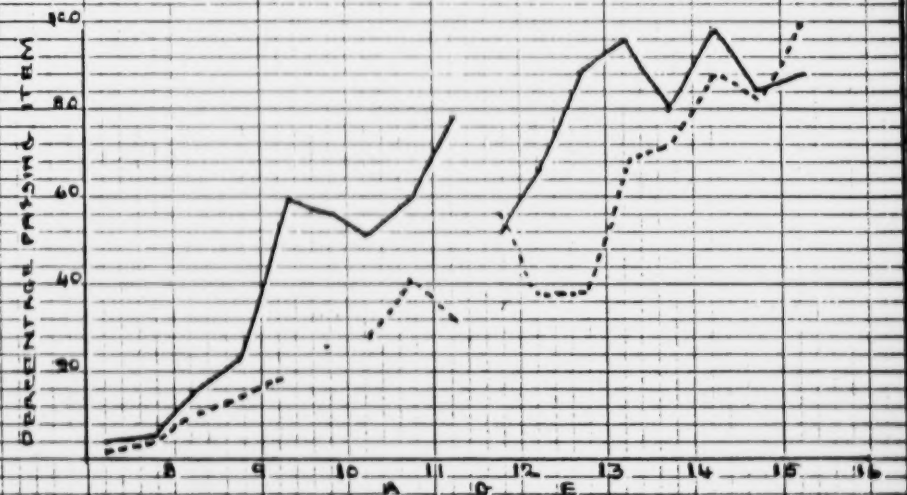
12 ROOMS: PROPORTIONS



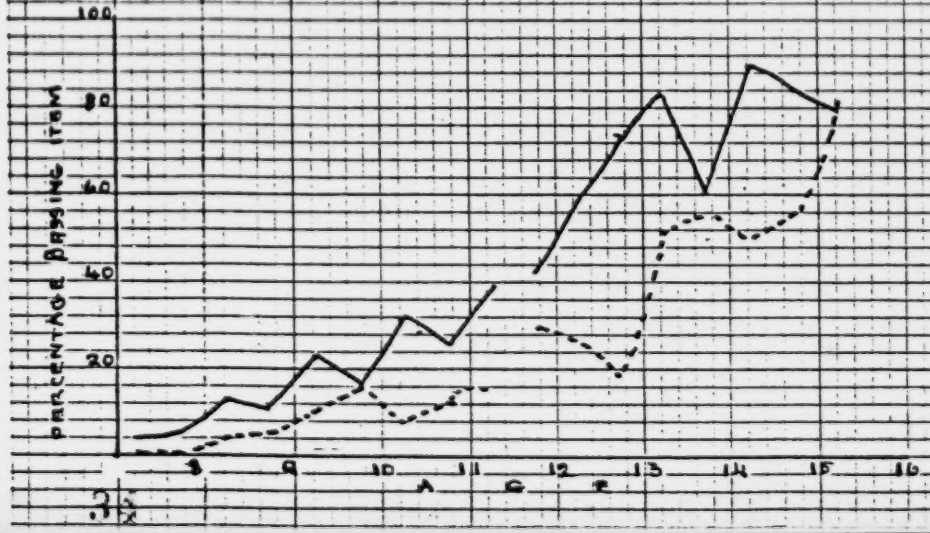
13 HALL I



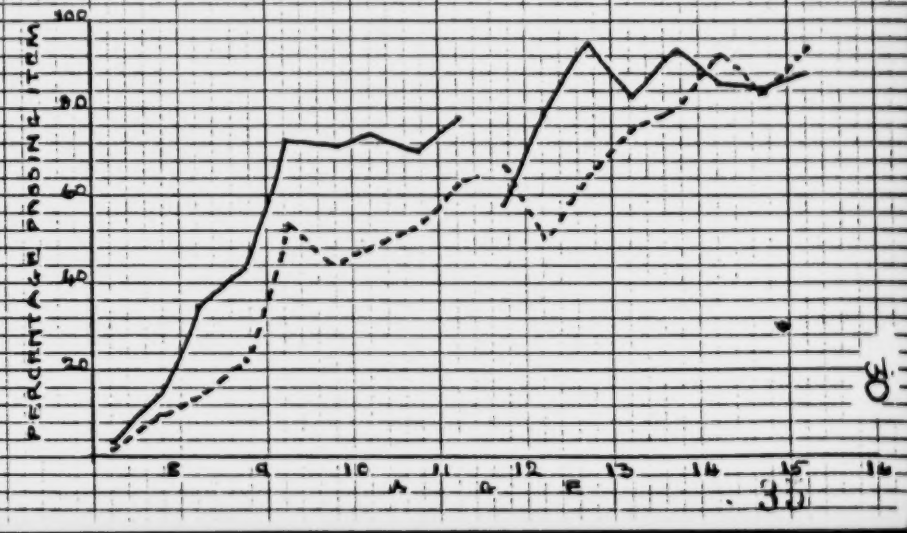
14 HALL II



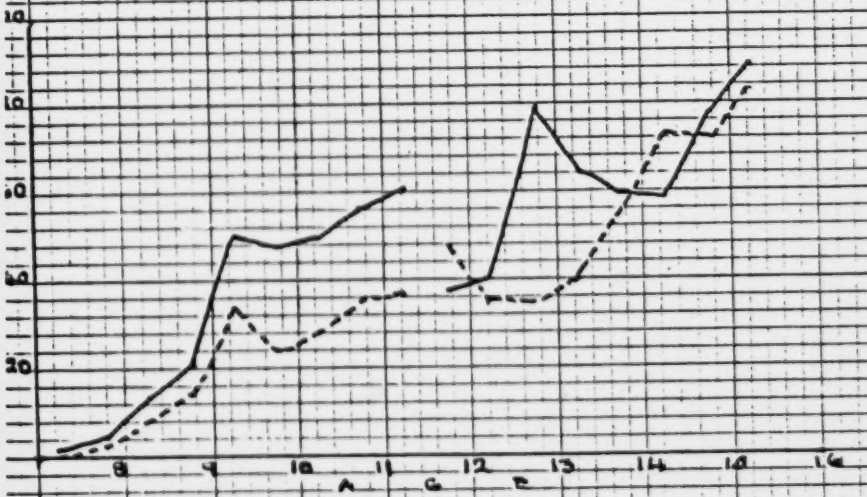
15 HALL: PROPORTIONS



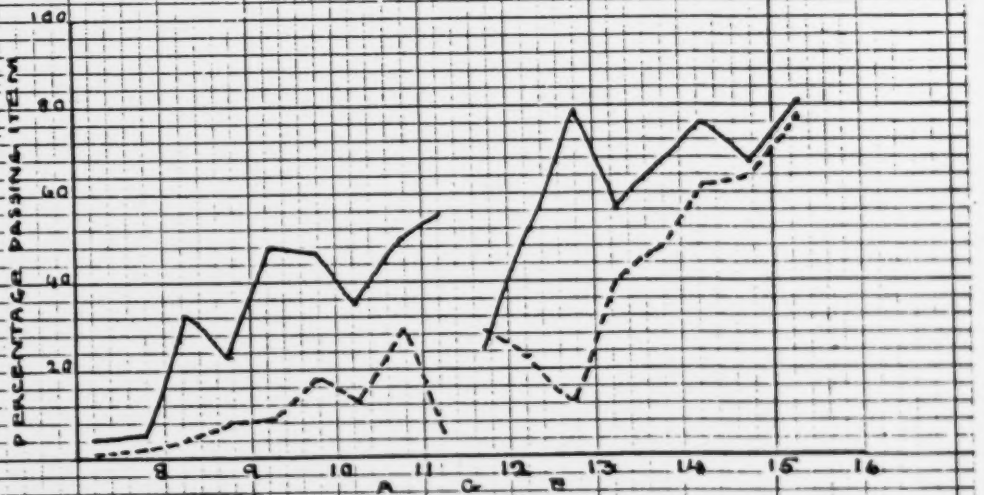
16 HORIZONTAL STAIRS



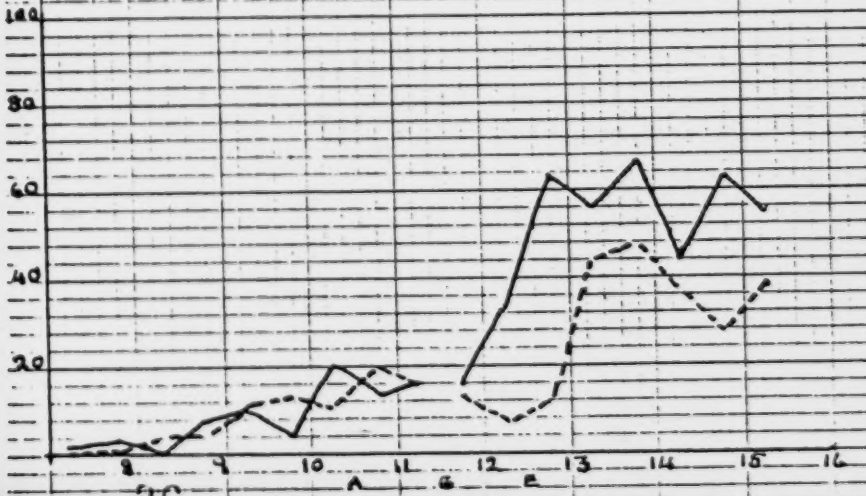
17. STAIRCASE I



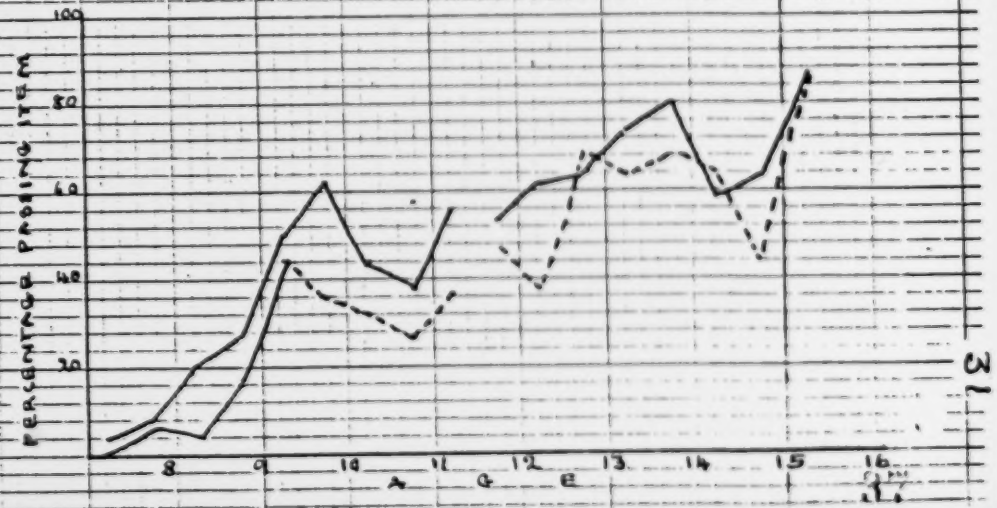
18 STAIRCASE II



19. STAIRCASE: PROPOPORTION

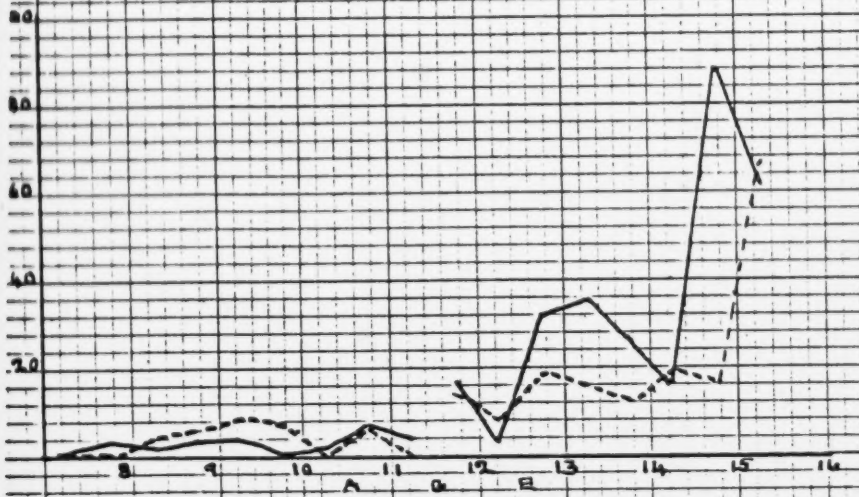


20 TREADS I

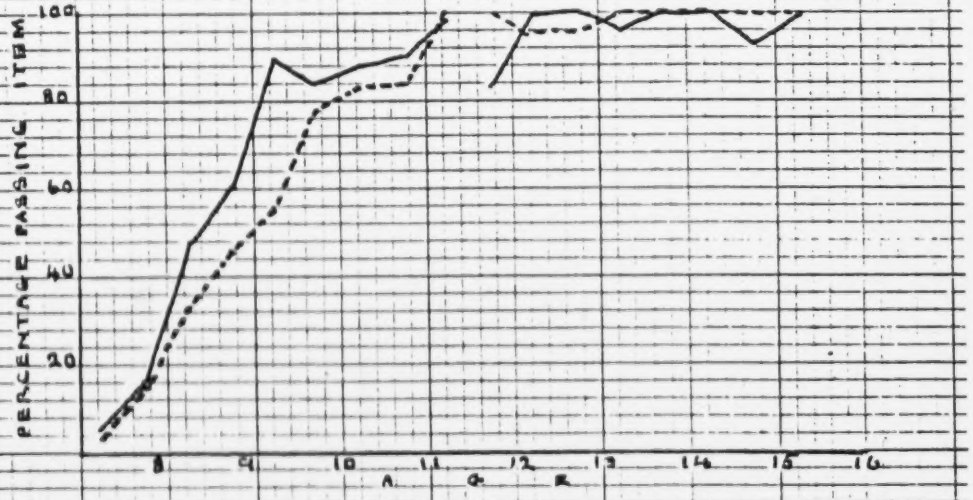


BOYS ——
GIRLS - - -

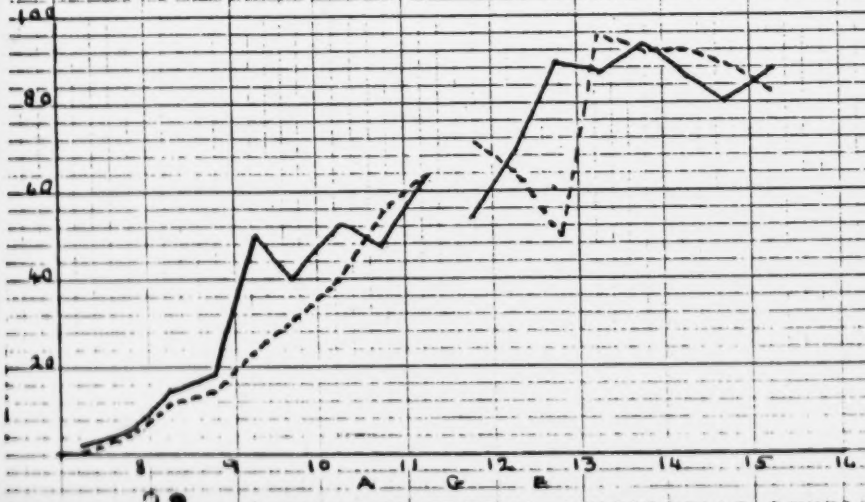
21 TREADS II



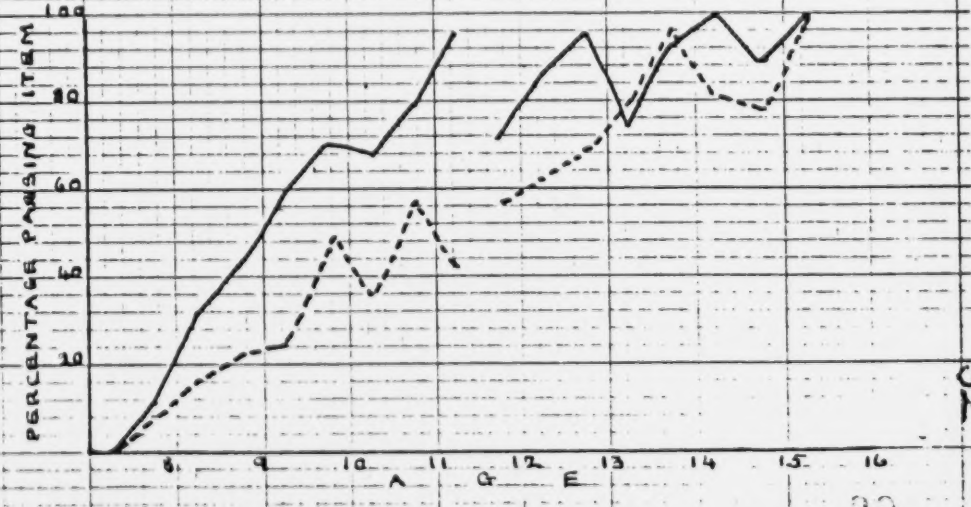
22 DOORS: NUMBER I



23 DOORS: NUMBER II

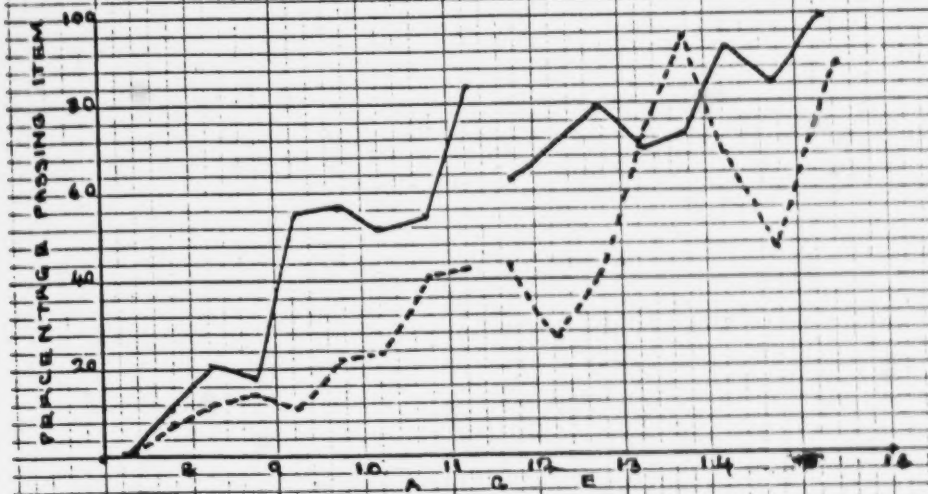


24 DOORS: TYPE I

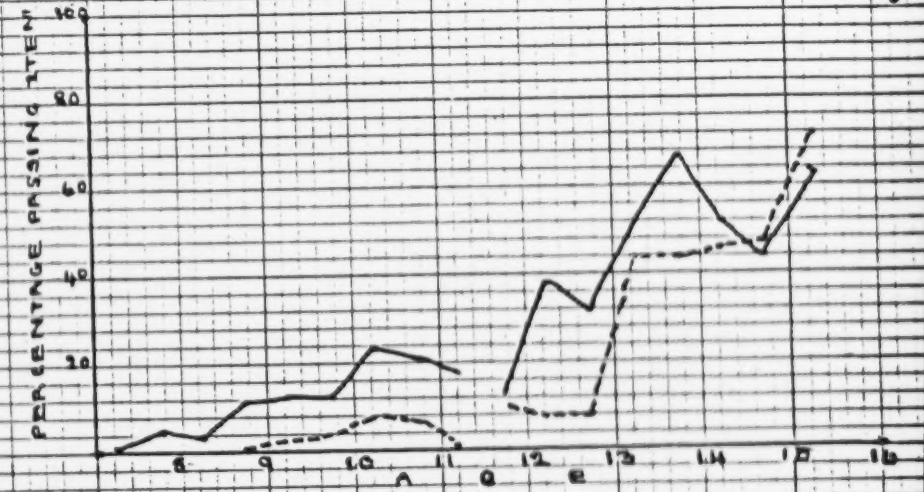


BOYS ——
GIRLS - - -

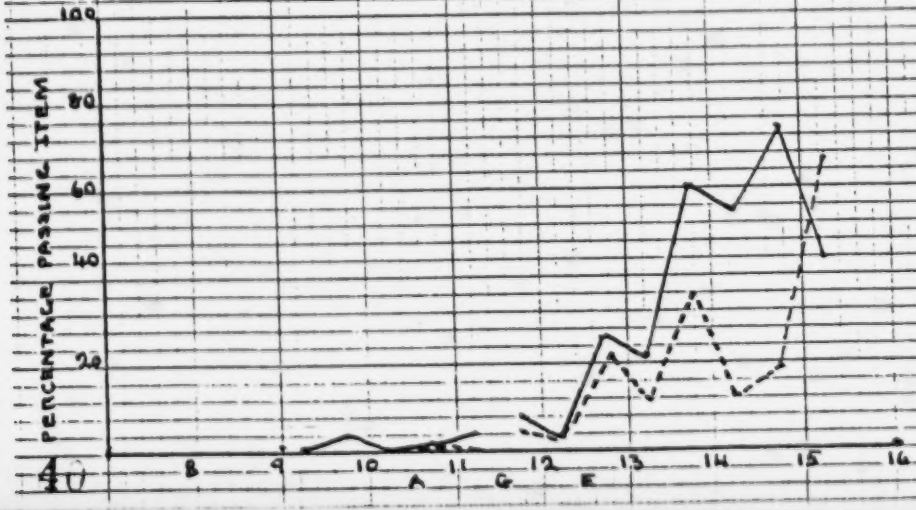
25 DOORS: TYPE II



26 DOORS: TYPE III

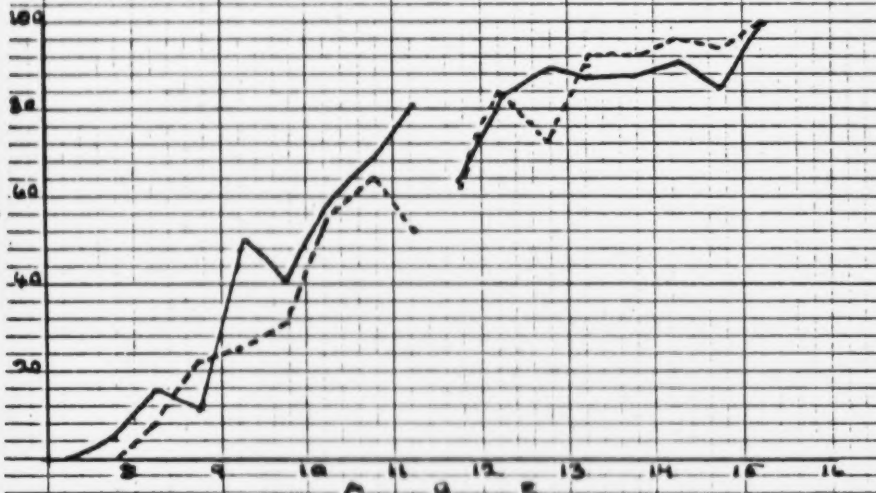


27 DOORS: PROPORTION

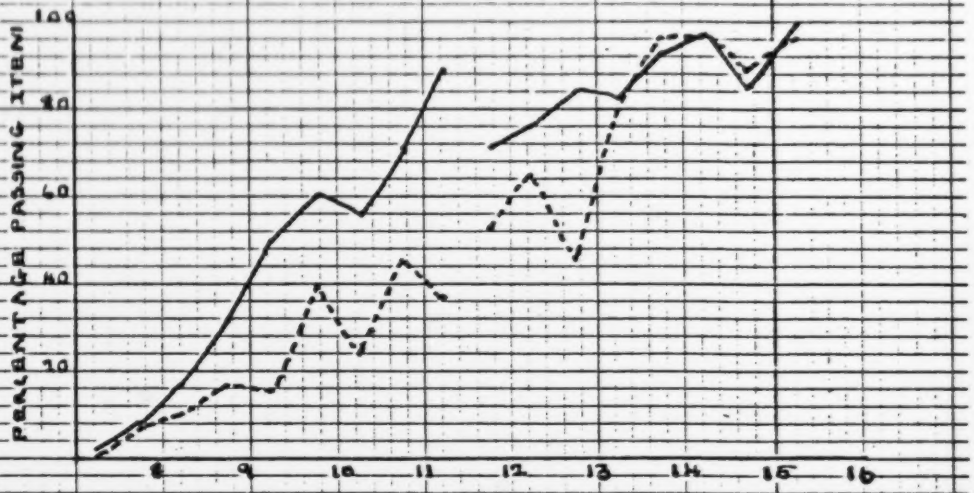


28 WINDOWS: NUMBER I

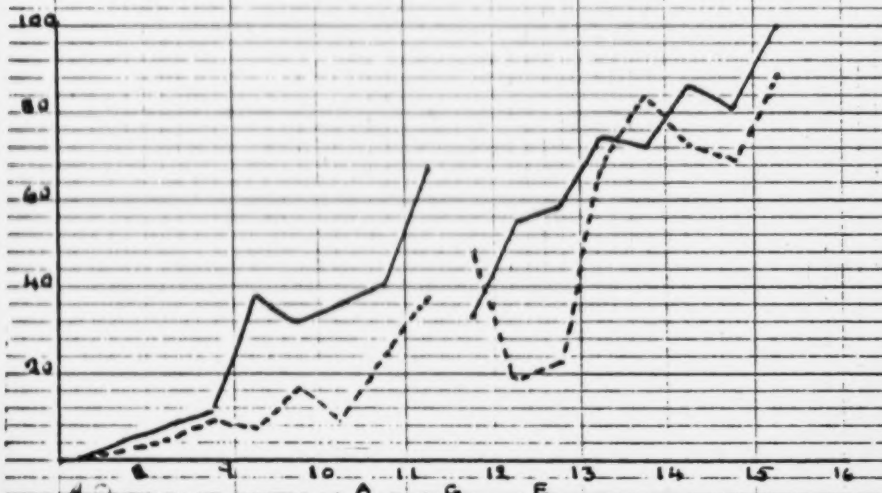
29 WINDOWS: NUMBER II



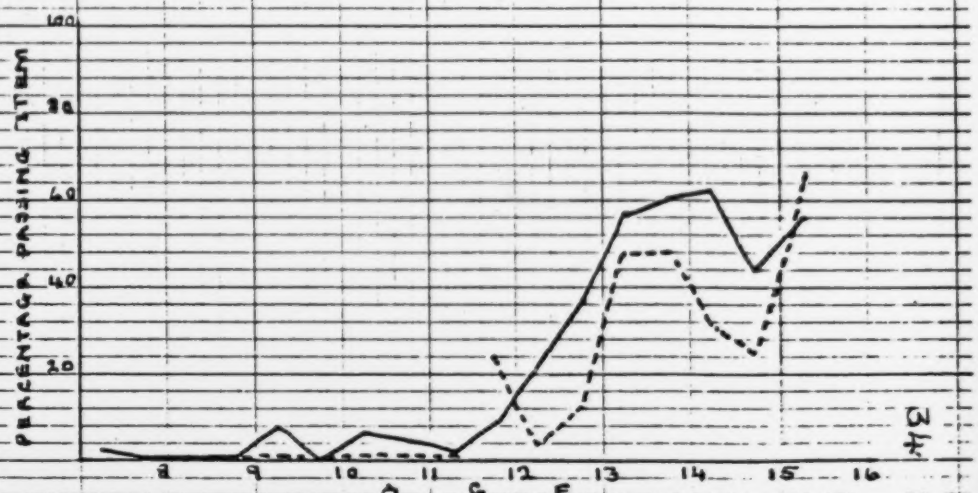
30 WINDOW: TYPE I



31 WINDOW: TYPE II



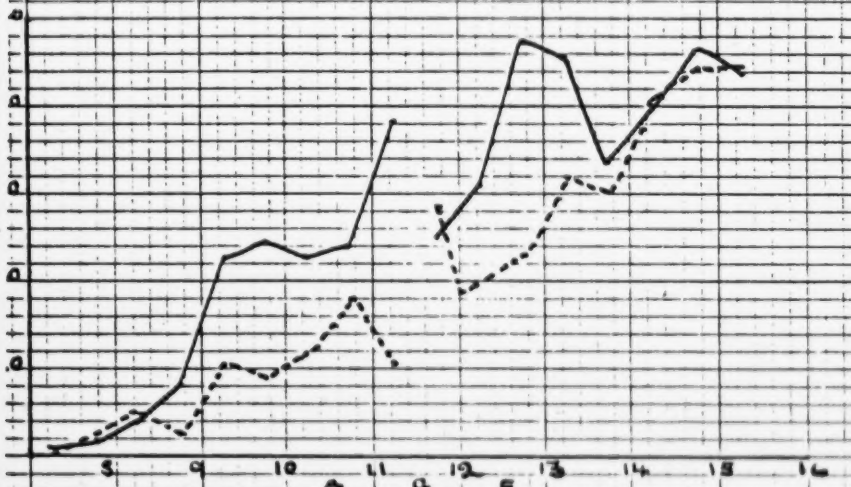
32 WINDOW: TYPE III



34

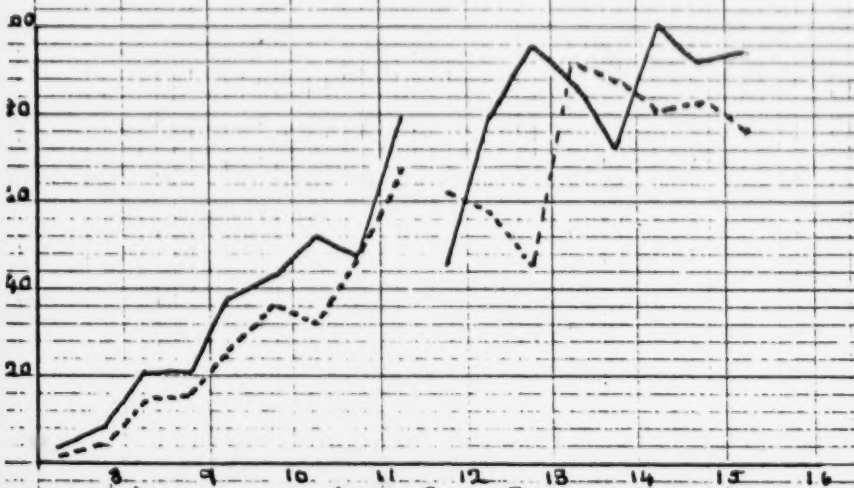
Boys —
Girls ---

33 NO UNACCOUNTED FOR SPACE

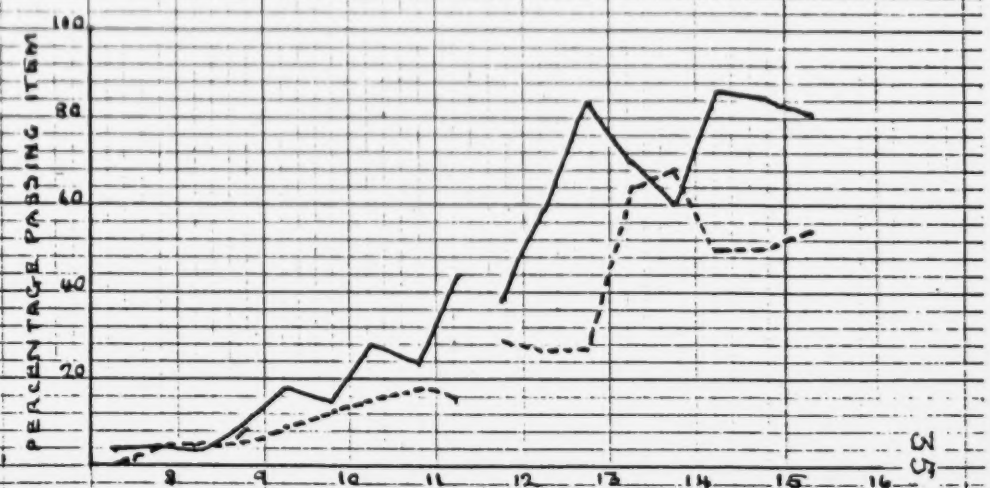


34 NO VERTICAL WALLS

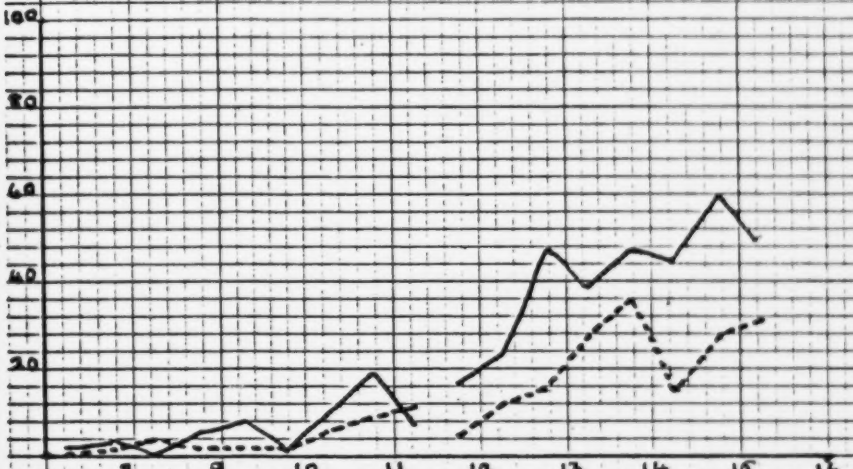
35 PROPORTIONS I



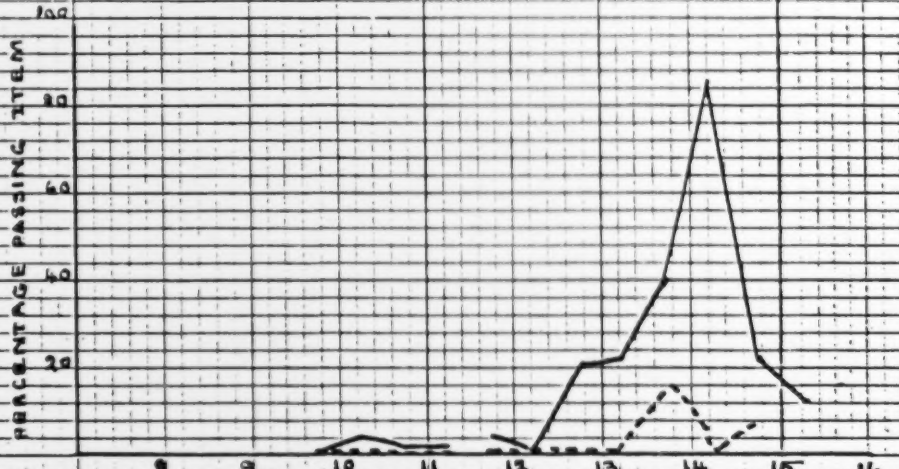
36 PROPORTIONS II



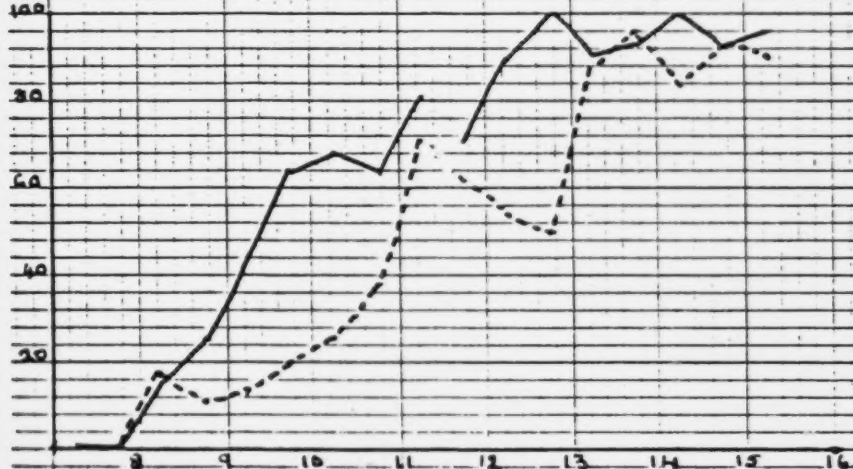
37 PROPORTIONS III



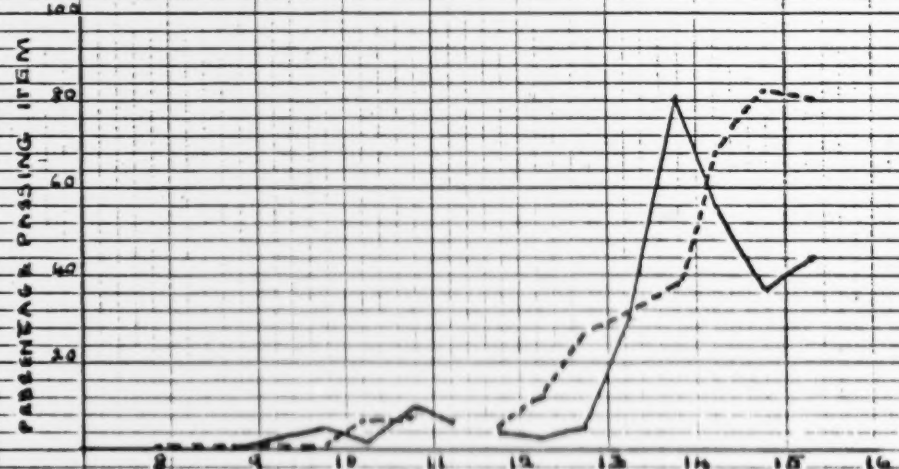
38 PROPORTIONS IV



39 QUALITY OF DRAWING I



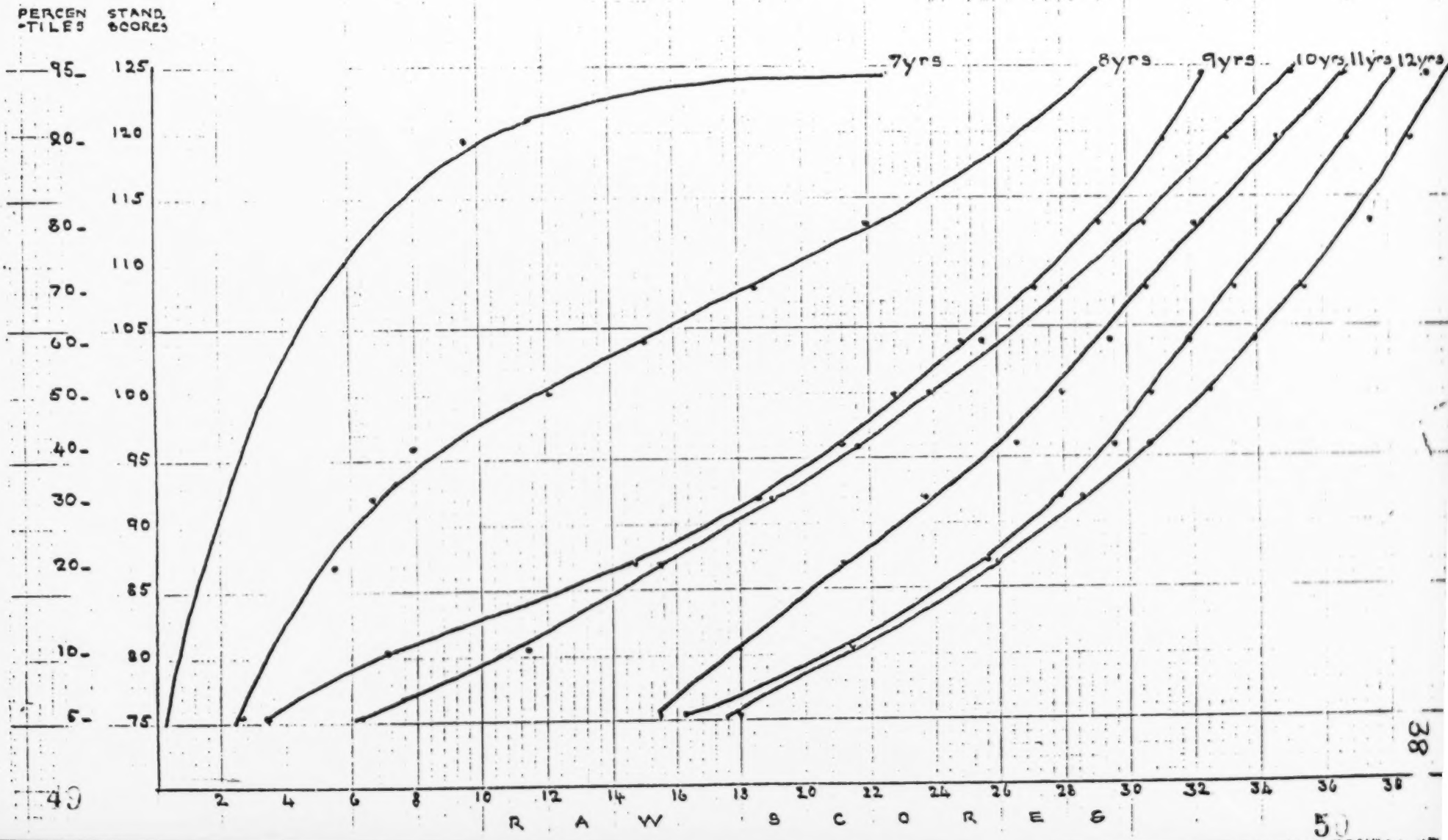
40 QUALITY OF DRAWING II

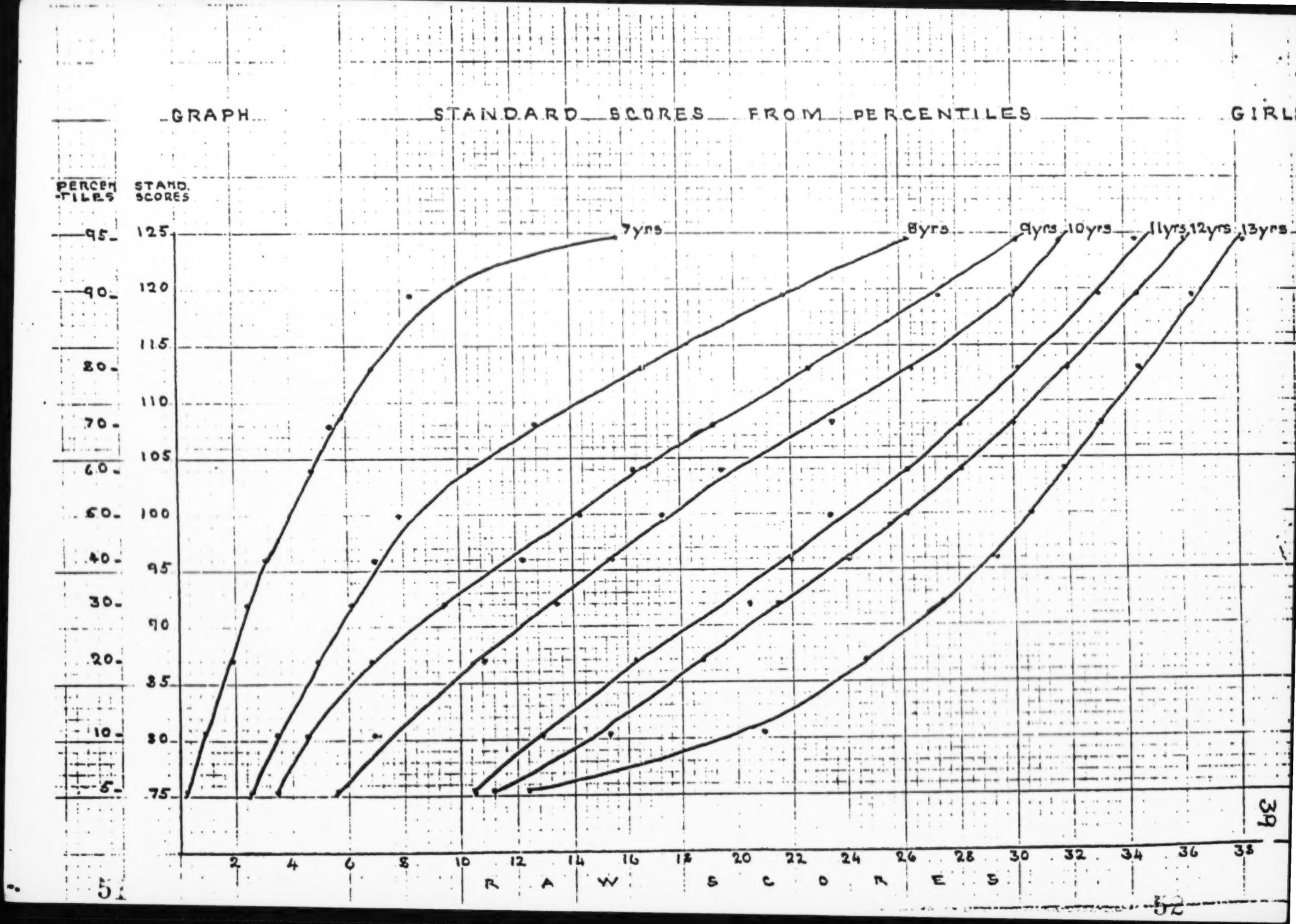


APPENDIX C

Percentiles and standardisation

GRAPH STANDARD SCORES FROM PERCENTILES BOYS




GRAPH STANDARD SCORES FROM PERCENTILES GIRLS
PERCEN-TILES
STAND. SCORES
95
90
80
70
60
50
40
30
20
10
5
125
120
115
110
105
100
95
90
85
80
75
7yrs
8yrs
9yrs
10yrs
11yrs
12yrs
13yrs
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38
RAW SCORES
34
51
52

STANDARD SCORE EQUIVALENTS FOR RAW SCORES BASED ON TOTAL SAMPLE

RAW SCORE	BOYS CHRONOLOGICAL AGE						
	7	8	9	10	11	12	13
40							125
39							121
38						125	117
37					125	120	113
36					123	117	110
35				125	120	114	107
34				121	117	110	104
33			125	119	115	108	101
32			122	116	112	104	99
31			119	114	110	101	96
30			116	112	107	98	94
29		125	113	109	104	95	93
28		123	110	103	101	93	91
27		121	108	105	98	90	89
26		119	106	104	96	88	87
25		117	103	102	94	86	86
24		115	101	100	92	84	84
23		114	99	98	90	83	82
22		113	98	96	88	82	81
21		111	96	95	86	81	80
20	124	110	94	93	85	80	79
19	124	109	93	92	83	78	77
18	124	108	91	91	81	77	75
17	123	106	90	89	79	76	
16	123	105	89	88	77	75	
15	122	104	88	87	75		
14	122	103	87	87			
13	121	102	87	84			
12	121	100	86	82			
11	120	99	85	81			
10	119	98	84	80			
9	118	97	83	78			
8	116	95	82	77			
7	113	93	80	76			
6	111	90	79	75			
5	107	87	78				
4	103	83	77				
3	98	80	75				
2	90	75					
1	81						
0	75						

RAW SCORE	GIRLS CHRONOLOGICAL AGE						
	7	8	9	10	11	12	13
40							
39							125
38							121
37						125	118
36					125	121	115
35					122	117	112
34					119	115	108
33				125	116	113	105
32				121	114	110	102
31			125	119	113	108	99
30			122	117	110	106	96
29			120	115	108	103	94
28			119	113	106	102	92
27			117	112	104	100	90
26		125	115	110	102	98	88
25		123	114	109	100	96	86
24		122	113	108	98	94	85
23		121	111	106	96	93	83
22		120	110	105	95	90	82
21		118	109	104	93	89	81
20		117	107	102	91	87	80
19		116	106	100	89	86	79
18		115	105	99	88	84	78
17		114	103	97	86	82	77
16	125	112	101	95	85	80	77
15	124	111	99	93	83	79	76
14	124	109	97	92	81	77	75
13	123	108	96	90	79	76	75
12	122	106	94	88	77	75	
11	121	105	93	86	75		
10	120	103	91	84			
9	118	101	90	82			
8	116	99	87	80			
7	113	96	85	77			
6	109	92	82	75			
5	104	88	78				
4	100	84	75				
3	94	79					
2	87	75					
1	81						
0							

Responses to questionnaire

1b Why was it difficult?

B Irrelevant reasons

These were usually related to the execution of the task and included "Don't knows". "Because I never had a ruler" (5)
"To keep things straight" (7)
"If you do something wrong you would not like to show the teacher." (8

C Relevant reasons

These centred round the difficulties of method and recall.
"I didn't know what shape. First I thought I should get it in a square. (18)
"I got a bit muddled up in the shapes of the house. (20)
"Have to get rooms the right width. (27)
"Difficult looking down" (30)
"I found it hard to memorize it" (27)
"Because you are not in the house" (18)
(A girl gave the longest answer, an example of verbosity).
"My house is ever so difficult. If you look into the window, it has got a piece of wood at the top and square at the bottom and looks out into the back garden. There's the living and the dining room and on the left the kitchen. From the dining room you have to go up some stairs. In the living room you can go right round in a circle from kitchen and dining room. When you go to the right, you go down into the kitchen and on the left is the back door" (11)

2b Why is it the best?

B Irrelevant reasons

Most of their reasons were concerned with the number of articles represented, the size of the plan and its execution.
"More things in it" (22)
"Because its bigger" (10)
"Spread out more and you can see it better" (18)
"I haven't got the writing squashed up" (24)
"Neater" (13)

C Relevant reasons

Many of the children referred to specific items on their plans which had improved.
"Hall is too wide. Stairs aren't correct" (27)
"Marked out rooms better" (19)

"Looks better in a square. Looked from outside" (18)
"I looked through here and this time I looked down" (15)
"Door was wrong this way because it doesn't take up so much room. Windows, they are at the side where they are, but these are in the middle of the room" (23)

3b How could it be improved?

B Irrelevant reasons

These were mainly concerned with execution
"Could be a bit smaller" (19)
"Make lines straighter" (22)
"Put in furniture" (22)

C Relevant reasons
These referred mainly to specific items
"The dining room is in the wrong place" (17)
"Not make room so big. Could make it a better shape" (12)
"Improve stairs. They go upwards above lounge" (15)

4b What is the difference in viewpoint between a plan and a picture?

B Irrelevant reasons
These often referred to the emptiness of a plan except for writing and the furniture and colours in a picture. (28)
"Nothing in it" (19)
"Plans marked with names. Pictures is just drawing"
"No pictures on the walls" (13)
"Put colours in a picture, but not in a plan" (13)
"There'd be writing inside the room, if its a plan" (6)
"Plan not coloured, a plan is labelled" (23)

C Relevant reasons
These are usually, but not always connected with the difference in viewpoint.
"Picture through here and a plan down" (15)
"When you make a plan you look down and when you do a picture you look that way" (22)
"Able to see it from the side not the top" (18)
"Don't have to concentrate so much on what you do. A picture is more like a room" (30)
"Windows in a different place" (17)

Most of the irrelevant reasons given to the first three questions

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